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NEW GUINEA, CROSSROADS AND SOURCE OF GEGETATIONS [1]

P. van Royen [2]

One look at the map will show that New Guinea's position has been an excellent one for receiving vegetations from all sides, at the same time being in a position from which plants radiated out to neighboring islands.

Its position at the eastern end of the line of large islands of Indonesia and the Philippines, and its position north of Australia, provided the New Guinean stock of plants with elements of a variation not often found in other places in the world, and it is estimated that apart from the great Amazon basin New Guinea has one of the richest floras in the world with about 17,000 species distributed over about 200 families and about 1600 genera.

At the other end New Guinea, by way of the numerous islands in the Pacific, provided that area and the New Zealand/Australian area with many plants, in return receiving and passing on plants coming from South America, the Antarctic Continent (in its warmer times) and New Zealand to Indonesia, the Philippines and even South China and Japan.

Owing to its large size - after Greenland it is the largest island in the world - the species that arrived in New Guinea has many chances to produce local variations and it is not surprising to find many endemics in New Guinea almost in every genus, though proportionally less than in Hawaii. This, however, may be a matter of taxonomic

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1/ This article is based on a lecture delivered at the November 6, 1967, meeting of the Hawaiian Botanical Society.

2/ Botanist and Chairman of the Department of Botany, Bernice P. Bishop Museum.

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interpretation of the latter vegetation that could be evaluated differently by modern botanists than has been done by earlier ones.

To complete the picture many plants from a more temperate region, in this case the northern temperate areas, have reached New Guinea and are now mainly found in the subalpine and alpine areas. There may be a few exceptions to this. For instance, the genus Euphrasia may not be a northern temperate genus, but is probably a genus that started in the southern temperate areas and from there expanded to the northern latitudes.

This in a nutshell is the story of the vegetation of New Guinea. Now for some details.

As stated before New Guinea is the second largest island in the world. Found just north of Australia it is perched like a bird on Qucenland's most northern cape, Cape York. It has a surface of just over 3/4 million square kilometers and stretches from about 130° to 150° East Longitude and from the Equator to slightly over 10° South Latitude. From its most western point at Sorong to its Southeastern tail it is almost 2000 km long, and it reaches a width of 800 km. The backbone of the island is a mountain system up to 200 km wide and up to 5040 m high in Mount Carstensz in West New Guinea. In the northwest is a double-headed peninsula, the Birdhead's Peninsula, connected to the rest of the island by a narrow, muddy isthmus. This peninsula is in many instances the home of Malaysian species that do not reach further east. On either side of the central ranges two large flood plains, drained by some large rivers, form the swampiest parts of the island. A distinctive feature of the central ranges is the vast series of wide, well-watered valleys, which often carry an extensive population. These valleys proved in many cases beneficial to the formation of new species as new arrivals could not be crossed away so easy by penetrating species, a phenomenon later repeated on a smaller scale in Hawaii, and explaining in some ways the amount of endemics in New Guinea. Eternal snow in the form of small glaciers is found only on the three highest peaks in the western parts of these ranges.

Volcanoes are few in New Guinea and rarely very active. They are mainly located in the eastern part or just off the coast in Vitiaz Strait between New Guinea and New Britain. The last fatal explosion was that of Mount Lamington in 1951 near Popondetta, killing two thousand natives.

Rivers are found in all sizes, from permanent sluggish rivers meandering across the large swamps in north and south, to fast, crystal clear creeks in the alpine areas.

Geologically New Guinea is very young though formations of Cambriam and Permian age are found. The island is still subjected to many active processes of orogenesis and many earthquakes and tremors testify to this activity. In general the orogenic movements have been vertical rather than horizontal and none of the great overthrusts known from the European Alps are found. The upheaval of the central ranges is assumed to have started in the Oligocene and was most active in the Plio-Pleistocene, so really in the last minutes of the geological time scale. In its geological history it can be noted that for most of the time one or a few islands now comprising New Guinea, had occasional connections with Australia.

The climate of New Guinea in accordance with its geographic position is that of the wet equatorial belt, and it is remarkable for its monotony. Rainfall is heavy,

increases with altitude, but decreases again in the highest altitude, and in the alpine areas occasional snowfall is reported. The lowest rainfall is in the southern areas and around Port Moresby with about 1000 mm per year, while at Ninati in the centre of the highlands at c. 1700 m altitude the average is well over 6000 mm annually.

Situated in the wet tropical belt the forests are all of the tropical rainforest type. This is the most luxurious vegetation in existance and includes a wealth of forms unsurpassed elsewhere. The development of the forests depends in the tropical belt mainly on temperature and water supply. On the basis of these two factors many different types can be distinguised, such as the mangrove forests, the savannah forests and the subalpine forests.

What is the composition of the vegetation in New Guinea? So close to Australia one can expect a vegetation dominated by Australian species. One could even expect this all the more since New Guinea has been connected at some time or another with parts of Australia and is connected to the large source of plants in Southeast Asia only by numerous small islands. The contrary is true, however, and the vegetation of New Guinea is essentially a Malaysian one. This can be illustrated by the following figures from an analysis of the Monocotyledons carried out several years ago and as yet unpublished. Of the 1614 genera of Angiosperms and Gymnosperms in New Guinea, 450 genera belong to the Monocotyledons. Of these the genera found in Africa, Asia, and Malaysia number 214 or almost 50%. Only 45 genera are of Australian origin, just 10%, almost the same number and percentage respectively, 43 genera and 9.7%, as the endemic genera in New Guinea.

There are a few more observations which show that New Guinea has an essentially Malaysian vegetation. If we study the number of Malaysian genera found in New Guinea and not in Australia this turns out to be almost 600, while Australian genera found in Australia and New Guinea and not in Malaysia total only 70. The classical example of this sudden break, not at the generic level but rather at the species level, is the genus Rhododendron. There are about 150 species in New Guinea and only 1 in Australia.

What other elements do we have in New Guinea apart from the Malaysian? First, of course, there is the Australian element, expressed for instance by the species of Acacia, Eucalpytus and Tristania. The largest number of Australian species are found in the dry savannahs in southern New Guinea, one in the mangroves and the remainder in the higher altitudes.

A third element that joined the New Guinea vegetation is the Circum-anarctic element. Species of this group are mainly found in the higher altitudes and the most characteristic ones are the two species of Araucaria. More important for economic reasons are the extensive forests of southern beech (Nothofagus). This is a Circum-antarctic element found in South America, New Zealand, Tasmania, Australia, New Caledonia and New Guinea, but has found its main development in New Guinea. In this group also belong such genera as Astelia, Acaena and Tetramolopium, all genera that reached Hawaii as well, all probably by way of a hypothetical landbridge in the southern Pacific, though this bridge may have consisted of several large islands or island groups larger than those found now.

The fourth element is a rather unexpected element found so far south which belongs to the northern temperate regions. This element is represented by the genera Gentiana, Drosera, Viola, Swertia, Ranunculus, Gnaphalium, Trigonotis and others. The gentians,

buttercups and the Euphrasias are particularly well developed and are taxonomically often difficult to separate. In New Guinea this element is found mainly in the alpine areas where the many species of Tetramolopium are also found.

These four types of foristie elements show the lines of plant invasion of New Guinea and the adding to the title of the word "source" should be clear by now. When the four elements reach New Guinea at one time or another almost immediately the formation of new variations started, culminating in many new species. This is shown most clearly in the New Guinean orchids where the number of endemics is about 60% of the total of 3300 species, but is equally clear in Rhododendron, Ranunculus, Hebe, Helicia and others. Also the number of endemic genera is rather high in New Guinea, among them Detzneria, Papuzilla, Piora, Keysseria, etc.

New Guinea has been a source of plants in another direction. For this we mainly have to look at the Pacific and Hawaiian vegetation. When I made my first field trips in Hawaii, I could easily imagine myself being in New Guinea again. Genera like Metrosideros, Styphelia, Vaccinium, Pittosporum, Exocarpus, Santalum, Plantago, and Psychotria, all these are found in New Guinea, undoubtedly with different species. Certainly there are no Clermontias, no shrub-like Bidens species in New Guinea, but also no Papuzilla and no Detzneria in Hawaii. However, these genera tend to obscure the issue as they are mainly derived genera. But it all points to a relationship with Malaysia and the most logical step to take is to regard New Guinea as the source of these genera found in Hawaii and the Pacific.

These short notes must suffice to give a slight idea of the problems involved in the study of the New Guinean vegetation, and most of them have not even been attacked!

ANNUAL REPORT OF THE SECRETARY FOR 1967

During 1967 the assets of the Hawaiian Botanical Society were very substantially increased with the receipt of over $7,000 from the estate of Marie C. Neal. The Society established a Marie C. Neal Memorial Account which will be used for grants to students in the plant sciences once the principle has reached $10,000.

Wish Awards at the Hawaiian Science Fair were presented to Cheryl Ling of R. L. Stevenson School and Bernice Ushijima and Susan Yokoyama of Kula Elementary School, Maui, both in the Intermediate Division.

The Outstanding Young Botanist Award was presented to Mr. Ross D. Mobley, of the Botany Department.

About 25 persons joined the Summer Foray led by Mr. Tom McGuire in Kipapa Valley. Dr. Robert Warner conducted plant donations for refreshments at the April and November meetings.

At the regular meetings during the year, the following talks were presented:

January 9	"Plants with Rhythm," by Dr. Douglas Friend, Department of Botany, University of Hawaii.
February 6	"Importance to the People of Hawaii of Conservation of Natural Scenic Resources," by Robert Wenkham, Professional Photographer.
March 6	"New Zealand - A Botanist's Impressions," by Dr. Charles H. Lamoureux, Department of Botany, University of Hawaii.
April 3	"A Visit to the Rain Forests of Malaya," by Dr. Hsuan Keng, Department of Botany, University of Singapore.
May 1	"On Nature Conservancy - The Evolution of the Modern Philosophies," by Dr. Helmut Lieth, Visiting Professor, Department of Botany, University of Hawaii.
June 5	"Japan in Cherry Blossom and Maple Times," by Dr. Harry F. Clements Plant Physiology Department, University of Hawaii.
October 2	"Experimental Biology of the Space Frontier: The Behavior of Living Matter Under Unusual or Harsh Environmental Conditions," by Dr. S. M. Siegal, Botany Department, University of Hawaii.
November 6	"New Guinea, Crossroads and Source of Vegetations," by Dr. Peter van Royen, Bishop Museum.
December 11	"Fiji Revisited," by Dr. A. C. Smith, Department of Botany, University of Hawaii and Retiring President.

HAWAIIAN BOTANICAL SOCIETY

REPORT OF THE TREASURER FOR YEAR ENDING NOVEMBER 30, 1967

Cash Balances 12/1/66:		$	
Petty Cash		3.84	
Commercial Account		366.26	
First Federal Savings & Loan Association		1,689.56	$ 2,059.66
Receipts:			
Dues		$ 676.00	
Marie C. Neal Bequest		7,391.25	
Contribution - Dr. L. C. Smith		10.00	
Contribution - Refreshment Fund		50.00	
Interest on Savings		273.06	8,400.31
			$10,459.97
Expenditures:			
Secretary's Expenses		$ 538.99	
Treasurer's Expenses		50.41	
Miscellaneous Expenses		12.99	
Dues, Contributions and Prizes:			
Nature Conservancy	$ 10.00		
Conservation Council	5.00		
Haw'n. Botanical Gardens Foundation	25.00		
Friends of Foster Gardens	25.00		
Hawaii Science Fair Awards	40.00		
Outstanding Botanist Award	25.00	130.00	732.39
			$ 9,727.58
Cash Balances 11/30/67:			
Petty Cash		$ .43	
Commercial Account		323.28	
First Federal Savings & Loan Association:			
Savings Account		638.99	
Marie C. Neal Memorial Account		8,764.88	$ 9,727.58

1967 Dues Outstanding		28	$ 75.00

The following resolution was passed at the meeting of the Hawaiian Botanical Society held on December 11, 1967:

WHEREAS:

The Hawaiian Botanical Society was founded to promote the study and appreciation of the Hawaiian and other flora, and

WHEREAS:

The pursuance of this purpose finds the society with the related interest of maintaining and encouraging the preservation of natural vistas and plant and wildlife areas, and

WHEREAS:

There are still significant numbers of rare Hawaiian endemic plants growing on Diamond Head, and

WHEREAS:

The development of the area around Diamond Head (including the areas Poni Moi and Hibiscus Dr. to the ocean, Diamond Head Road and Fort Ruger) for high rise and heavy density residential areas would greatly detract from the natural beauty of Diamond Head by virtue of the removal of the vegetation, and by blocking the view of the crater from many areas without and within the basal area of Diamond Head, and could result in the destruction of some of the native plants still growing there, and,

WHEREAS:

A zoning ordinance prohibiting the creation of the aforementioned high rises and high density housing, as is already evident on Kiele St. and Kalakaua, would preserve the natural beauty of a landmark known in Hawaii and throughout the world, and,

WHEREAS:

The eventual creation of a park extending from Kapiolani Park to the Lighthouse on Diamond Head Road would ensure preservation of the slopes of Diamond Head in an aesthetically pleasing way,

BE IT RESOLVED THAT:

The Hawaiian Botanical Society go on record as favoring the adoption of a zoning ordinance which would prevent any further residential or hotel apartment development of the aforementioned area, and would favor the eventual establishment of a park extending from Kapiolani Park to the Lighthouse.

REVIEW

Otto & Isa Degener

Bernhard Zepernick of Berlin, Germany, in Baessler-Arch. Beitr. Voelkerk. Bd. 15:329-365. 1967, deals with "Bemerkungen zur Faerberei der Polynesier" or, roughly translated, "Remarks about Polynesian Dye Plants." The article deals with about 100 species , giving their correct scientific names (without authorities, however) and indicating when necessary the synonyms used by about 60 authors in over 90 articles. The commonest dyes are gained from Curcuma longa, Aleurites moluccana and Morinda citrifolia. The author describes the plants used for certain dyes (blue and green are rare), in what island groups they are used, on what materials, and their vernacular names. The reviewers wish to alert the reader that Solanum nigrum was in Polyesia long before the coming of the Caucasian explorers, and that Ricinus communis is a common, naturalized weed. Two endemic species of Rubus exist in the Hawaiian Islands and hence the name of one should not be a synonym of the other. Mr. Zepernick, with aid of five tables, has given us in less than 50 pages what the usual author might give us in a booklet of 150 or more. The study is of general interest to botanists as well as anthropologists dealing with the islands of the Pacific.

BOTANICAL SOCIETY NEWSNOTES

New Officers Elected: At the December meeting of the Hawaiian Botanical Society, the officers for 1968 were elected. They are:

President: Dr. Daniel D. Palmer, M.D. Dr. Palmer is a physician and surgeon specializing in dermatology.

Vice President: Dr. Douglas Friend, Associate Professor of Botany, University of Hawaii.

Secretary: Mr. William Sakai, N.E.E.A. Fellow in Botany, University of Hawaii

Treasurer: Dr. Paul Ekern, Professor of Soil Science and Hydrologist, Water Resources Research Center, University of Hawaii.

Directors: Dr. A. C. Smith, Wilder Professor of Botany, University of Hawaii, the retiring President of the Society.

Dr. Richard W. Hartmann, Assistant Horticulturist, University of Hawaii, the retiring Secretary of the Society.

Bush Elected to Life Membership: Mr. William M. Bush, for the past 27 years the Treasurer of the Hawaiian Botanical Society, was unanimously elected a Life Member of the Society at the December meeting. During 1968, Bush will retire from his position as Executive Vice President of Castle and Cooke, Inc.

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(Physician, Rm. 222, 1481 S. King St.)
VICE-PRESIDENT.....Dr. Douglas Friend
(Dept. Botany, Univ. Hawaii)
SECRETARY.....Mr. William Sakai
(Dept. Botany, Univ. Hawaii)
TREASURER.....Dr. Paul Ekern
(Water Resources Research Center,
Univ. Hawaii)
DIRECTORS.....Dr. A. C. Smith
(Wilder Prof. of Botany, Univ. Hawaii)
.....Dr. Richard W. Hartmann
(Dept. Horticulture, Univ. Hawaii)

THE HAWAIIAN BOTANICAL SOCIETY was founded in 1924 to "advance the science of Botany in all its applications, encourage research in Botany in all its phases," and "promote the welfare of its members and to develop the spirit of good fellowship and cooperation among them." "Any person interested in the plant life of the Hawaiian Islands is eligible for membership in this Society."

EDITOR. . . . . .Charles H. Lamoureux
(U.H. Botany)

THE HAWAIIAN BOTANICAL SOCIETY NEWSLETTER is published in February, April, June, October, and December. It is distributed to all Society members with the purpose of informing them about botanical news and progress in Hawaii and the Pacific. News contributions and articles are welcomed.

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